DIVISION 14
LIGHTING

SECTION 1400
ROADWAY LIGHTING

1400-1 DESCRIPTION

This section applies to the Roadway Lighting only and not to sign lighting or signals. For guidance in these areas, see the appropriate sections.

All work shall be performed in accordance with the specifications, plans, and the National Electrical Code. A copy of the National Electrical Code (NEC) may be obtained through the Engineer, from an Electrical Supply company.

Although the Contractor is expected to be an expert in the trade, do not assume that all workers are skilled in this work. If questions arise over permitted procedures or code questions, technical assistance can be obtained through the Engineer from the Roadway Design Unit.

The Specification reference to the Contractor having licenses of proper classifications refers to the electrical contracting company, not necessarily to the individual doing the work. The company is expected to have a responsible person available on the project and a licensed person available if the need arises.

The Contractor is required as part of his work to furnish two accurate sets of as- built plans. The Technician should check with the Contractor periodically to ensure that information is being documented accurately. It is suggested that the plans be updated daily with a marked set of as-built drawings as a minimum.

1400-2 MATERIALS

(A) GENERAL

All material used for the Lighting System shall be approved by the Engineer prior to use. The approval for the bulk of these materials is handled through submission of Catalog Cuts.

The requirement that all materials be new implies that they should be delivered to the project in boxes or packages that will provide protection until the time of actual installation. Almost all manufactured materials have a label that shows the manufacturer's name, catalog number, and basic ratings or specifications. The information on the label should be compared with approved submittals (catalog cuts) to verify that the materials are acceptable. Warranty and installation instructions are often included in the shipping carton and should be filed with other project documents, not thrown away.

Manufactured Electrical materials tested by third party inspection agencies for compliance with industry standards should be so noted by a label or mark to indicate compliance with the standard. This mark or label should be compared with the approved submittals to assure compliance.

Materials used in lighting and electrical work should comply with domestic product certification requirements of the contract. This does not necessarily mean that small components, such as screws in circuit breakers, or electrical or lighting materials have to be in compliance. The requirement would be applicable to large items such as light standards, high mast, conduit, wire, lamps, and luminaires.

(B) CONDUIT

Conduit shall be of the type and size specified. Use similar materials throughout the entire system. Conduit from several manufacturers may be approved, but they should not be indiscriminately mixed throughout the project. If a problem occurs with a particular manufacturer, it is desirable to have all of the manufacturer's material in one general area of the project. This does not preclude using manufacturer "A" fittings with manufacturer "B" conduit.

There are two types of metallic conduit that look very similar and are assembled with the same type of fittings. They are rigid galvanized steel conduit, normally referred to as "RGC," and intermediate galvanized steel conduit, normally referred to as "IMC." IMC has a thinner wall and is not specified for lighting and electrical work on Department projects.

There are two types of non-metallic conduit. Non-metallic rigid PVC (polyvinyl chloride) heavy wall conduit approved for above ground and underground use without concrete encasement is most often referred to as "PVC schedule 40." Non-metallic High Density Polyethylene (HDPE) conduit is approved for underground use only. HDPE is delivered on reels in continuous lengths, and may be installed by trenching or directional drilling methods. Other non-metallic conduits commonly used for utility power and telephone work such as Type "A," "B," "C," "D," "EB," and "DB" are not specified for lighting and electrical work on Department projects.

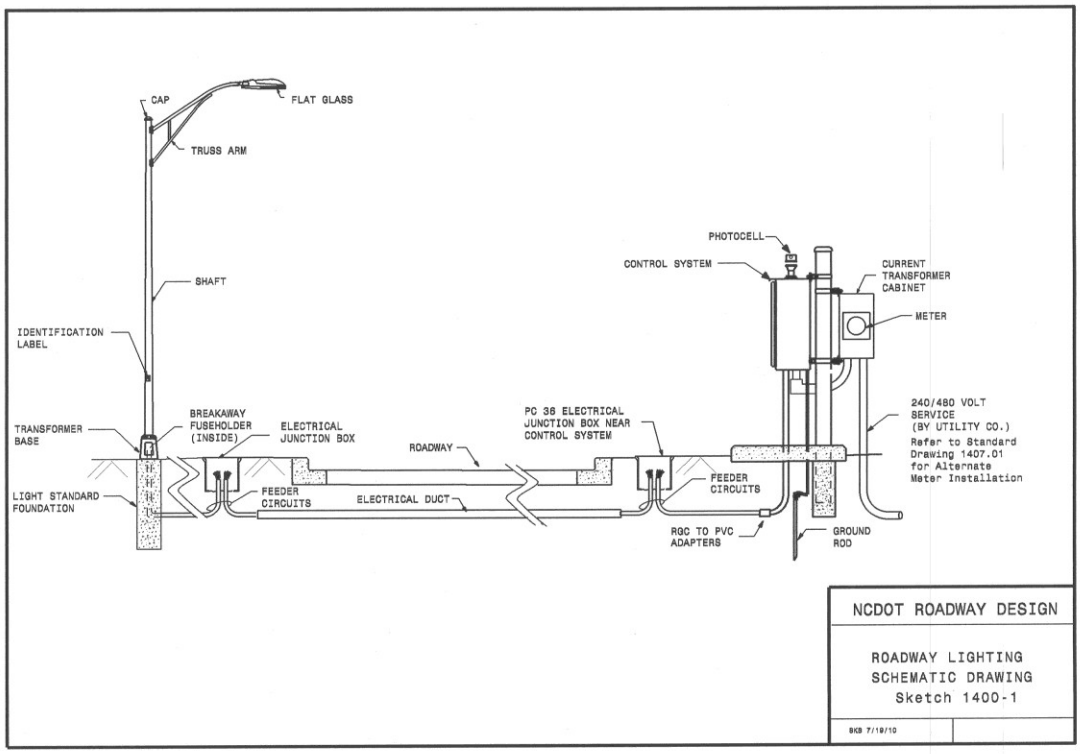
Care should be used during placement to protect the conduit from the intrusion of water, mud, and other foreign materials.

(C) WIRE

Wire shall be of the size and type shown on the plans. The normal and customary types are shown for the various circuits and uses. Wire from several manufacturers may be approved but should not be indiscriminately mixed throughout the project. See Sketch 1400-1 for the typical locations of the various circuits.

(E) FUSEHOLDERS

This is an in line fuseholder that is separate and independent from the control panel fuse or breaker. Breakaway fuseholders are required at all breakaway light standards.



Sketch 1400-1

Sketch 1400-1
Refer to Standard Drawing 1407.01 for Alternate Meter Installation

(F) HARDWARE

Incidental hardware is normally approved on site, without requiring submission of catalog cuts, etc.

(G) LAMPS

The lamps are warranted for minimum hours of operating life. Each lamp shall be date coded on the base so the burn life can be determined.

(H) DUCT & CONDUIT SEALER

Commercially available sealer satisfying the intended purpose may be approved on site. There is no approved list for this material. Read the manufacturers' carton for recommendations.

1400-3 SUBMITTALS

(A) CATALOG CUTS

The Contractor is required to submit 8 copies of catalog cuts for all materials proposed for use. These submittals should be made early in the project to avoid delays. Submittals are required for several reasons, including (a) to verify that the Contractor understands the contract requirements and proposes to provide what is specified, (b) to document agreement that what is proposed meets the requirements of the contract, (c) to give the Technician assistance in determining that materials and construction methods meet the requirements of the contract, and (d) to provide documentation for future use in the maintenance or renovation of the system.

Submittals (catalog cuts/shop drawings) should be grouped according to the contract bid item and also by the type of work. It will help to expedite the review process if submittals for roadway lighting work are kept separate from submittals for other work, such as sign lighting work.

Normally, all eight copies of each submittal are forwarded to the Roadway Design Unit, where review comments are noted and distributed with the eight copies as follows. One copy is sent to the Materials & Tests Unit, two copies are retained by the Roadway Design Unit, and five copies are returned to the Resident Engineer. The Resident Engineer should keep one copy for the project files and provide one copy to the Technician. The remaining three copies should be returned to the Contractor.

Catalog cuts should show the manufacturer's name, specific catalog number, description, and ratings. Sales literature and price lists are not acceptable.

The Specifications permit up to 40 days to review the submittal. As an exception to the normal process, critical submittals may be expedited through the Engineer for priority handling. The Contractor should not expect, nor be led to believe, that the Department will expedite the review just because he failed to provide the submittals in sufficient time prior to wanting to begin work.

Approved catalog cuts are required prior to delivery.

(B) CERTIFICATIONS

Various materials may require certifications to satisfy Specification acceptance requirements. The different types of certifications are defined under Article 106-3 of the Specifications. Material certifications should accompany the delivery of material to the project; however, in many cases this does not occur. When certifications do not accompany the delivery of materials, the Technician should receive the materials in the normal manner and request that the Contractor supply the proper certification. Generally, the material has been approved based on the approved catalog cuts and may be installed on this basis. Final approval and acceptance will not be made until the Specification requirement has been verified by testing or certification.

(C) SAMPLES

Most materials utilized in roadway lighting work are approved based on certifications and/or catalog cuts. There are occasions when it is necessary or desirable to verify conformance with the Specifications by sampling the material supplied. Materials typically sampled include anchor bolts, luminaries, reinforcing steel, etc. Samples may also be required to verify the workmanship associated with the construction. Samples of electrical conductor splices should be obtained to establish an acceptable level of workmanship. Adequate sampling of these and other items

should be made randomly to ensure conformance to the Specifications. It is recommended that the Contractor submit an electrical splice so field personnel can have a sample to compare.

The lighting Specification allows for payment of samples upon written request from the Contractor. This was intended to compensate the Contractor for any costly and more expensive materials taken. This allowance is different than our usual approach of considering samples incidental with no direct payment. Payment under this Specification only applies to roadway lighting items.

(D) AS-BUILT PLANS

Upon completion of the work the Contractor is required to furnish two complete and accurate sets of as-built roadway lighting plans. One set shall be forwarded to the Roadway Design Unit and the other(s) placed inside each control panel. In order to provide accurate as-built plans, it is important for the Contractor to maintain the plans daily and for the Department personnel to verify that this is being done throughout the life of the lighting work.

The as-built plans should be in the form of our roadway plan lighting sheets (1/2 size) with appropriate changes and additions made. These should be received and reviewed by the Engineer for accuracy. The as-built plans should be furnished upon completion of the work and in no case later than final payment.

(E) WARRANTIES

All warranty information should be supplied to the Division Traffic Services personnel maintaining the lighting systems. Check with your Division for proper handling of warranty information.

(F) COMPUTATIONS AND WELDING PROCEDURES

The Engineer should check for the correct number of submittals. The review for these procedures may take up to ten weeks. This is more than the standard 40 day turnaround for submittals, so it is important for the Engineer to discuss this at the preconstruction conference and advise the Contractor to submit them 6 months before needed on the project to ensure there will be no delays in obtaining approval.

1400-4 CONSTRUCTION METHODS

(A) LOCATION SURVEYS

All proposed light locations shall be located as shown on the plans and shall be reviewed and approved by the Engineer prior to installation. The Engineer shall check the proposed location to ensure that these locations do not conflict with other roadway features, such as signs, utilities, underground and overhead, drainage, etc. Review the control system locations as staked in the field with the local power company to ensure they can provide electricity to the system. Care should also be taken to avoid locating foundations, junction boxes, and circuits in drainage ways or in traffic hazard areas. Major adjustments from plan locations should be approved by the Roadway Design Unit.

Elevations of foundations should be checked to ensure that foundations conform to the finished roadway sections. Special care should be taken when units are of breakaway design to ensure that the proper distance between the graded cross section and the top of the footing is

achieved. Foundations in planting areas should be set above the mulch elevation. Minor adjustment to the finished roadway section and/or additional grading may be necessary adjacent to foundations to ensure proper fit. The anchor bolts and top of foundation should not be covered by earth material or trapped water.

For contracts that include the item of contract surveying, the proposed location and elevation of lighting foundations is part of the work required by Construction Surveying. Major stakeout changes to the original lighting plan would be treated as extra work and paid accordingly.

(B) DAMAGE TO FACILITIES

State law requires the Contractor to notify the N.C. One Call Center (1-800-632-4949) before digging (refer to 105-8, cooperation with utility owners, for the Contractor's responsibilities). Not every utility is a member of One Call so the Contractor should be cautious even after locating is complete. A listing of known utility owners is contained in the project utility provisions. The location of existing underground facilities should be determined before excavating for foundations. Locating existing facilities is the responsibility of the Contractor. The existing facility shall be relocated or adjustments made to the foundation location when practical to avoid conflict. The Contractor shall take all necessary precautions to avoid damage to the existing facility. Damage to existing facilities due to negligence of the Contractor shall be repaired to the owner's satisfaction at no cost to the Department.

(D) OPERATION OF EQUIPMENT

The Contractor shall operate equipment in a safe manner. Lane closures may be required when working adjacent to the travel lane, usually within 10 feet or closer (see the traffic control plans). Materials and/or equipment shall be stored away from the travel way, usually no closer than 40 feet. On projects that are open to traffic, the Contractor should not operate vehicles contrary to traffic laws.

(E) CONDUIT INSTALLATION

The joining and alignment of conduit should be checked by the Technician prior to backfilling. Damaged or restricted sections should be replaced or corrected before covering. Field bends shall be made in accordance with accepted industry practice. Particular attention should be made at field cut locations and tie-ins at junction boxes.

Field cuts and damaged galvanization shall be coated with zinc-rich paint using 2 applications of brush coat in accordance with Section 1076-7 of the Standard Specifications. Touchup using spray application is not acceptable.

(F) WIRING METHODS

Lubricants shall be used to facilitate threading of wires through the conduit system. Approved lubricants shall be considered those recommended by the manufacturer for that purpose. Other soaps and oils which may adversely affect the insulation should not be permitted.

The proper color-coding should be checked and verified by the Technician for all conductors.

Splices are permitted under certain conditions. Sample splices should be submitted for the Engineer's approval of an acceptable level of workmanship. It is preferred to splice conductors "end to end" to avoid the problem of having to insulate the "straddle" of conductors spliced "side by side." Sample splices would also establish an acceptable amount of rubber and vinyl tape insulation.

(G) GROUNDING ELECTRODES

The term grounding electrode/rod is used interchangeably and in all cases, shall be used when required by the plans. Ensure that ground rods are of proper length.

(H) EQUIPMENT MOUNTING

Unless otherwise shown, electrical boxes should be mounted at eye level and in areas accessible to service personnel.

Assistance in locating equipment should be obtained from the Division Traffic Services personnel. They can offer suggestions on how they will maintain the system in the future and provide direction on how the Engineer can locate equipment to simplify access.

Special care should be taken when locating electrical junction boxes in the concrete median barrier. These are usually preset with slipform barrier placed around the in-place box. The finished slope of the junction box should match the slope of the face of the barrier per plan detail. This location is critical to provide a smooth transition free from offsets or irregularities in the wall face.

Mounting hardware shall not be less than one nominal size smaller than the equipment opening mount and shall be of sufficient length to obtain a fully threaded nut.

(I) BASE PROTECTION

Do not fill the space between the top of the footing and bottom of the base plate with grout. This space must be left open to prevent the accumulation of moisture inside the pole. Anchor bolt position and projection from the top of the foundation shall be as shown on the plans. Projecting threads shall be kept free of mortar and should be burred. Leveling nuts, washers, and top nuts shall be furnished and positioned as required on the plans. Top nuts shall be fully engaged with threads projecting either from the top of the nut or, at a minimum, flush with the top of the nut..

. A protective metal shroud must be installed underneath the light standard base plate to protect the exposed anchor bolts and lighting circuitry segments between the base plate and the top of the concrete median barrier (for median mounted light standards). Galvanized steel welded wire reinforcement must be installed between the top of foundations and bottom of mounting base for high mount standards.

1400-5 ELECTRICAL INSPECTIONS AND TESTING

The Contractor is required to provide a calibrated MegOhmMeter manufactured by Fluke, Amprobe, Biddle or Engineer approved equal to perform insulation resistance testing on feeder circuit conductors. The Contractor's findings must be documented on the Contractor Meg Circuit Data Form (available on the Roadway Design Unit website) and submitted to the Lighting and Electrical Squad of the Roadway Design Unit for review prior to final inspection.

The Contractor is responsible for having each electrical system inspected by the Office of State Fire Marshall of the Department of Insurance or local authority having jurisdiction. It is normal practice that the local authorities allow the State Electrical Inspector (Insurance Department) to perform the electrical inspections to ensure that the work is in conformance with the State Electrical Code. The State Electrical Inspector may be reached at (919) 661-5880. The State Electrical Inspector's name and telephone number should be given to the Contractor at the preconstruction conference. Each system can be inspected independently and can be inspected when approved by the Engineer. The Contractor shall provide the certificate of inspection of the electrical inspection prior to final acceptance of the project.

Inspection by the proper authority shall neither eliminate nor supersede the inspection by the NCDOT Engineering Personnel, such as the inspections and test required by Section 1400-6.

All permits and/or licenses are the responsibility of the Contractor.

Inspections by NCDOT personnel shall be made during the progress of the work as well as after the work is completed. Checks made for conformity shall be noted in the diary. Inspection shall be made of the luminaires' optical qualities at night by Department personnel accompanied by the Contractor.

The Engineer may contact the Roadway Design Unit (Lighting and Electrical Squad) for assistance.

The Contractor has full responsibility of the system until final acceptance of the project.

1400-6 BURN-IN TEST

This Specification is included to ensure that the lighting system installed will perform satisfactorily as intended prior to acceptance by the Department.

Prior to the 2-weekburn-in test, each feeder circuit shall be checked for satisfactory insulation resistance (the MEG Test). This test can be performed by the Roadway Design Unit. It should be scheduled after the wiring is completed. This is necessary to avoid restarting the burn-in period if conductors require replacement.

Performance tests shall be conducted in the normal burn-in cycle (not continuous burn) because this provides a better check on all controls. The Technician should verify that the lights are turned on and off at the proper time in the automatic mode. All circuits energized from the same supply point shall be tested during the same two-week period.

1400-7 IDENTIFICATION

Each major component of the lighting/electrical system needs to be identified by a number to assist in identifying the component when a problem arises. Law enforcement personnel may observe that a light is not operating and they can tell the Department personnel that light # XX needs repairing. It is important that the identification label or marking for light standards and high masts be located so that it can be observed from a moving vehicle. The basic method of identification is to assign a letter designation to each control system (locate this identification number where power is received from the utility company) and then a number

indicating the light standard or high mast location. Numbers generally are assigned from west to east or south to north, but there is no firm requirement. The identification designation that is shown on the plans shall be used unless specified otherwise by Roadway Design Unit. Any changes to the identification shown on the plans shall be recorded on the "as-built" plans.

Identification of the electrical conductors includes a color code of the conductors in conformance with National Electrical Code requirements and alpha/numeric identification to make tracing of circuits easier. The alpha/numeric identification is the letter designation of the control system from which the circuit originates and a number (usually 1-5) distinguishing the specific circuit. A circuit usually consists of three conductors: an equipment grounding conductor (color code GREEN or BARE COPPER, required by NEC), and two hot conductors (color code RED and BLACK). All of the conductors in each circuit have the same alpha/numeric (a/n) identification. The a/n identification shall be the same size and style for each of the conductors in the circuit. The circuit identification should not be confused with the light standard identification. They both use the control system letter designation as a prefix but the numeric portion is completely different.

Generally, the Contractors use paint to identify the light standards and adhesive labels along with colored tape for the circuits. The material used shall be approved for the application and shall be applied in a neat, workmanlike manner. The material has to be durable under very severe weather and use conditions. Handwritten letters and numbers are not normally acceptable. Submittals for the Engineer's review and approval of these materials are required.

Identification to be placed on control cabinets and other enclosures may require specific information, size, or location as indicated on the plans.

1400-8 LOCKS AND KEYS

The Contractor is responsible for keeping all enclosures containing electrical or mechanical components closed and secure for safety and protection from the environment. At the time of acceptance, all enclosures shall be closed and secured with approved locks (generally heavy duty type padlocks). Each Division has its own requirements for locks. Check with your Traffic Services Unit. Sometimes special holes have to be drilled for locks. The Division Traffic Services Supervisor shall be given a key for all the locks.

1400-9 ELECTRICAL SERVICE

It is the Contractor's responsibility to ensure that proper electrical services are available to the project and to have the services provided at the proper phase of construction. The Engineer shall ensure that the Contractor understands this responsibility and that the proper utility company has been contacted to ensure the electrical service can be provided. Locate poles outside the clear roadside recovery zone. The need for furnishing power shall be discussed with the utility company at the preconstruction conference. Accessibility of power supplies (service poles) shall be agreed upon by the utility company. Utility companies may or may not be notified of the location of services required prior to construction. The Engineer should notify the utility companies as soon as the contract is awarded and invite the utility company to the preconstruction conference.

The following steps should be followed in establishing electrical service as it relates to the billing procedures:

1. The Engineer should provide the Contractor a letter, addressed to the local electrical utility, authorizing the Contractor to obtain service(s) in the Department's name. This letter should

be provided at the preconstruction conference. This letter will give the Contractor the ability to have the service(s) connected in the Department's name with the bills sent directly to the Engineer's office. The letter to the utility company should remind them that the Department is tax exempt.

2. The initial electrical service should be requested by the Contractor. This will place the responsibility on the Contractor to ensure the required service is connected in a timely manner. When requesting service hook-up, the Contractor should give the project number, structure number, high mount number (if applicable), and station number. The Contractor should request that all of this information be placed on the bill by the servicing company, if possible. Once the Contractor has made the request, he should submit a list of all account numbers and corresponding location data as previously stated to the Engineer.
3. The bills should be sent directly to the Division Traffic Engineer. The Division Traffic Engineer can charge all expenses against the project as long as it is active.

1400-10 TERMINOLOGY

The term “ground rod” and “grounding electrode” are considered synonymous as used in the Standard Specifications. Used in a more technical aspect, a “ground rod” is a specific type of “grounding electrode” as noted in the NEC.

A “lighting system” is considered to include everything associated with the materials and equipment necessary to provide illumination that receives power from one service point. A project may have one or more lighting systems.

Electrical “duct” is a term used to designate a specific payment item and method of installation for electrical circuits. It is always constructed with approved electrical conduit and sometimes may be utilized as an NEC approved electrical raceway.

“Feeder circuits” extend from the control system circuit breakers to the fuseholders in the base of light standards or other overcurrent protection devices for branch circuits. See Sketch 1400-1, Page 14-3 for diagram of typical terms.

1400-11 CONSTRUCTION PHASING

A pre-lighting work meeting is to be scheduled by the Contractor prior to beginning lighting system work on the project. Staff members from the prime contractor, electrical subcontractor, Resident Engineer’s office, and the Lighting/ Electrical squad in the Roadway Design Unit should be included in this meeting.

1400-12 MEASUREMENT AND PAYMENT

Payment for samples taken by the Engineer to verify the compliance of items installed with the requirements of the contract will be made by supplemental agreement only upon request by the Contractor and only for the verifiable actual cost of the material. All other work is included and paid at the contract unit price for the various line code items in the contract.

SECTION 1401
HIGH MOUNT STANDARD

1401-1 DESCRIPTION

This section covers structural steel light standards (masts, supports, or poles) 60 feet or greater in height. Typical high mast pole heights used in North Carolina are 60, 80, 100, and 120 feet. A top latched lowering device with a portable drive unit is required for these structures.

1401-2 MATERIALS

(A) HIGH MOUNT STANDARD

All high mount light standards will be pre-inspected by the Materials & Tests Unit during fabrication. Standards will have a unique identification number die-stamped in each standard. A written inspection report will be forwarded to the Engineer when the standards have been approved by the Materials & Tests Unit. The information on the standard should be checked and must match the information on the inspection report. This form may state that the galvanizing was not inspected. If it has not been inspected, contact the Materials & Tests Unit Metals Engineer at (336) 993-2300 for inspection of the zinc coating at the project site. If the galvanizing has been pre-inspected, the standard will come to the project bearing the Materials & Tests approval stamp.

All high mount light standards will have a hand hole with a hinged and lockable door near the base of the standard. The hinge pins or bolts must be burred or otherwise made so removal is not possible. All hand holes must be locked during the life of the project. Different Divisions have different requirements for lock types. Check with your Traffic Services Unit.

The Contractor must provide certified computations and fabrication drawings by a professional engineer licensed in the State of North Carolina. Eight copies of detailed drawings and one copy of the complete design calculations for each height of standard shall be submitted for approval before fabrication. Ten weeks review time should be allowed for review and approval.

(B) LOWERING DEVICE

The lowering device is not pre-inspected by the Materials & Tests Unit. It should be carefully and thoroughly checked by the project personnel against the approved catalog cuts and shop drawings.

(C) PORTABLE DRIVE

The portable drive unit is not pre-inspected by the Materials & Tests Unit and should be carefully and thoroughly checked by the project personnel against the approved catalog cuts and shop drawings. This includes the case. All operating manuals and other manufacturer's documentation shall be maintained with the unit and shall be placed inside the case. At the completion of the project, the portable drive unit, including case, shall be turned over to the Division Traffic Services Unit.

(D) CIRCUITRY

All electrical circuitry shall be installed in strict accordance with the plans, specifications and the approved catalog cuts and shop drawings. Roadway Design Unit's Lighting and Electrical Squad Leader should be contacted at (919) 707-6200 if any questions arise concerning the electrical circuitry. All wiring shall be neatly routed and shall not be in contact with any part of the winch assembly. Care shall be taken to insure that the appropriate male and female insulation boots are used on the appropriate plugs and connectors.

(E) OPERATION

The portable drive unit supplied for the project must be used for the operational check of the lowering device. Special attention must be paid to the cables during the required 5 raisings and lowerings of the carrier ring to detect any twisting in the cables or unevenness in the ring. Division Traffic personnel should be invited to attend.

See Sketch 1401-2 for a typical arrangement of high mast light standard and lowering device.

1401-3 CONSTRUCTION METHODS

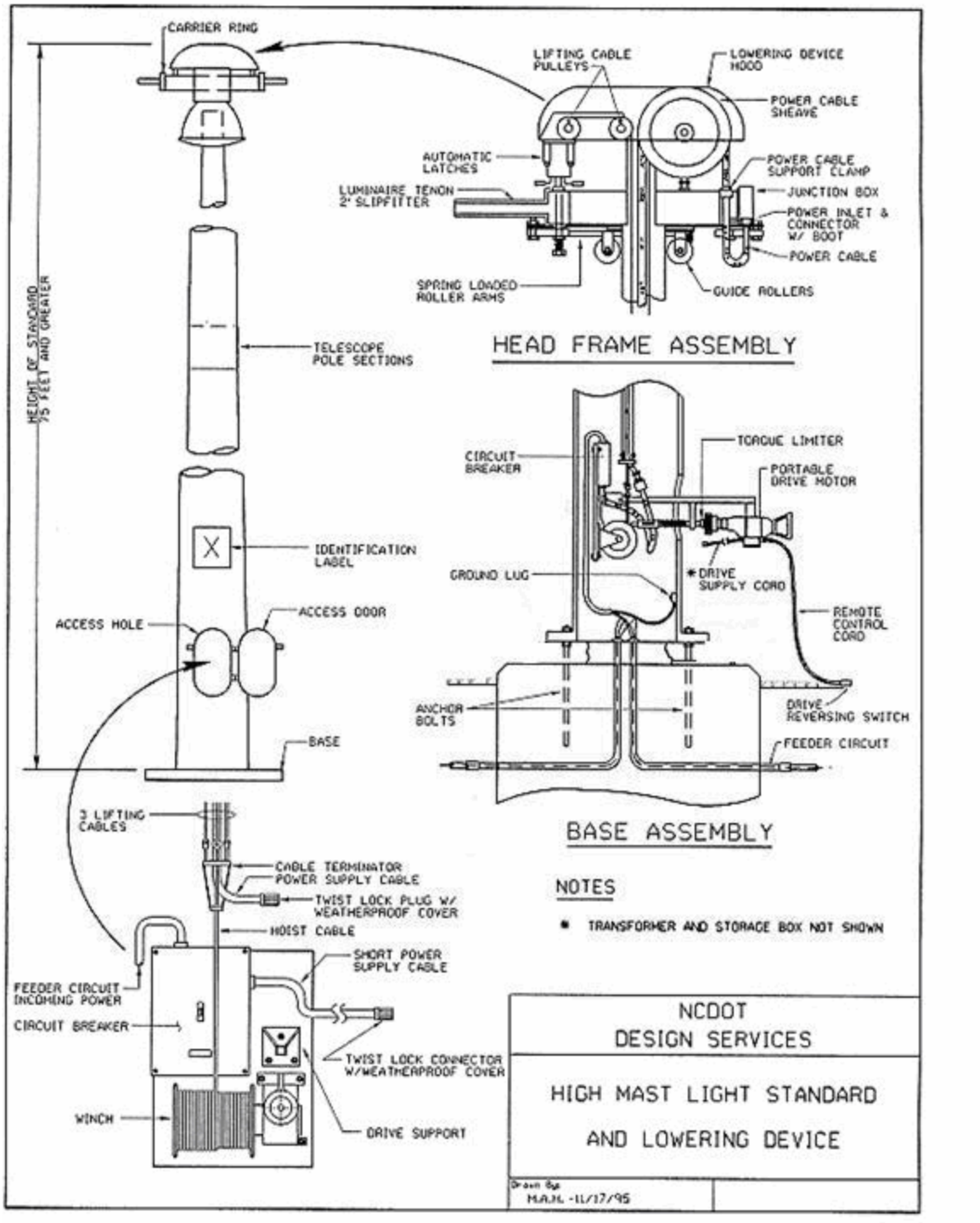
No welding, cutting, or drilling in any manner will be permitted in the field unless approved by the Engineer. Realignment of anchor bolt holes shall not be allowed.

The plumbness of the installed standard must be checked. This is most easily accomplished using 2 transits set up 90 degrees apart. This check should be performed early in the morning or late in the afternoon as the standard will bow due to differential heating from the sun.

All power cables and lifting cables shall be unrolled from their spools during installation. If the cables are allowed to uncoil off the spool, they will twist when installed. All manufacturers' directions must be strictly adhered to when installing the lowering device. The bolts or hinge pins on the hand hole door should be burred to prevent removal. Do not grout between the base plate and the top of the foundation footing. Install galvanized wire mesh between the base plate and the foundation, to prevent insects and varmints from entering the breaker/winch assembly compartment. Any special tools, accessories, or manuals for the lowering device or portable drive unit shall be placed in the case for the portable drive unit.

1401-4 MEASUREMENT AND PAYMENT

Materials payments may be made for fabricated standards if the standards have been inspected and approved by the Materials & Tests Unit. This can be verified with the inspection report submitted to the Engineer by the Materials & Tests Unit or by contacting Materials & Tests Metals Engineer at (336) 993-2300. Material payments may not be made for unfabricated steel for high mount light standards.



Sketch 1401-2

SECTION 1403
HIGH MOUNT LUMINAIRES

1403-2 MATERIALS

The Technician should verify that the manufacturer's catalog number on the high mount luminaires and lamps match exactly the catalog numbers on submittals which have been approved by the Engineer.

1403-3 CONSTRUCTION METHODS

The Technician should verify that the Contractor has marked the installation date on the base of the lamp. There is a series of letters representing the months of the year and the numbers 0 through 9 on the metal portion of the lamp base for use to mark the installation and removal dates of the lamp. A "/" mark through the appropriate letter indicating the month and the number representing the last number of the year show the date of installation. The "/" mark can be made (scratched) with a knife, or other sharp pointed object. Care should be given not to scratch the glass portion of the lamp.

Lamps should be screwed securely into the sockets and should be wiped clean. The glass portion of the lamps should not have any markings except those made by the manufacturer and should be completely free of handprints.

The equipment grounding conductor (GREEN wire) in the electrical cord serving each luminaire shall be connected to the designated grounding lug in each luminaire.

Luminaires shall be secured in a level position on the tenons (support arms) of the lowering device. The reflector, glass refractor, and lens shall be wiped clean.

SECTION 1404
LIGHT STANDARDS

1404-2 MATERIALS

This section covers structural steel light standards (masts, supports, or poles) less than 60 feet in height. Light standards less than 60 feet high are not pre-inspected. Project personnel should carefully and thoroughly check the standards, including the breakaway base, against the approved catalog cuts, shop drawings, and plans. If the standards are galvanized steel, the Materials & Tests Unit should be contacted to check the thickness of the zinc coating. These light standards may not have any identification marks on them. Therefore, they should be carefully checked dimensionally by the project personnel to ensure they are erected in the correct location. This may be the only dimensional check made on these standards.

1404-3 CONSTRUCTION METHODS

If the standard is located adjacent to the roadway, the footing must be at correct elevation for breakaway design. Care should be taken during installation to orient the base handhole for easy maintenance access. This should be discussed with Division Traffic Services Personnel. Care should also be taken to ensure that the proper mast arm is installed with the proper upright and that the assembled standard is installed in the proper location. When installing the nuts on the anchor bolts, be sure all threads are clean and lubricated to ensure that the proper bolt tension

can be achieved at the specified torque. This should also be done for the bolts connecting the bracket arm to the upright. Refer to Anchor Rod Nut Tightening Requirements for Metal Poles in Appendix E in Division 17 of this manual.

Nuts on anchor bolts shall have full thread contact. Check locations of standards against guardrail drawings and placement of guardrail.

SECTION 1406
LIGHT STANDARD LUMINAIRES

1406-2 MATERIALS

The Technician should verify that the manufacturer's catalog number on the light standard luminaires and lamps match the catalog numbers on submittals which have been approved by the Engineer.

1406-3 CONSTRUCTION METHODS

The Technician should verify that the Contractor has marked the installation date on the base of the lamp. There is a series of letters representing the months of the year and the numbers 0 through 9 on the metal portion of the lamp base for use to mark the installation and removal dates of the lamp. A "/" mark through the appropriate letter indicating the month and the number representing the last number of the year show the date of installation. The "/" mark can be made (scratched) with a knife or other sharp pointed object. Care should be given not to scratch the glass portion of the lamp.

Lamps should be screwed securely into the sockets and should be wiped clean. The glass portion of the lamps should not have any markings except those made by the manufacturer and should be completely free of hand prints.

Luminaires shall be secured in a level position on the bracket arm tenon (slip fitter). The reflector, glass refractor, and lens shall be wiped clean.

The weight of the branch circuit wiring inside the light standard shall not place strain on the electrical terminals in the luminaries. The connection of the branch circuit conductors to the fuseholders shall be made with approved tools. Crimping tools shall utilize dies that are the correct size for the wire and fuseholder lug. Fuseholders shall be installed with "line" side connections to the feeder circuits and "load" side connections to the branch circuit extending toward the luminaries.

SECTION 1407
ELECTRIC SERVICE POLE AND LATERAL

1407-2 MATERIALS

The wood service pole is a typical pole used by utility companies and should be the length and class specified on the plans. Catalog Cuts are not necessary because compliance with the Specifications is verified at the treating company by an inspection agency hired by the Materials & Tests Unit. Normally, the pole will have the treating company identification, plant location, month, and year of treatment, species (southern pine), treatment type (CCA), retention

of preservative, pole class, and length branded 12 feet from the base end. The pole shall be tagged and stamped.

1407-3 CONSTRUCTION METHODS

Service poles and laterals should not be installed by the Contractor until the service point and method is determined. If the service will be underground, the service pole work and compensation should be deleted from the contract. Also, the length of service lateral will be reduced.

Service pole locations shall be reviewed with the utility company providing service and Division traffic personnel to ensure there are no service problems. This should be done at the beginning of the project. Ensure the pole is placed outside the clear roadside recovery zone or behind barrier.

SECTION 1408
LIGHT CONTROL SYSTEM

1408-2 MATERIALS

The Technician should verify that the manufacturer's catalog number on each of the components of the control system match the catalog numbers on submittals which have been approved by the Engineer. The Technician should verify that the layout of the components inside the enclosure is in conformance with the details shown in the plans or approved drawings.

1408-3 CONSTRUCTION METHODS

The location of the control system may be adjusted for better alignment of circuitry and for accessibility by maintenance and utility personnel. Relocation of more than 50 feet shall be approved by the Engineer. The location shall be agreeable to the utility company. There should be adequate room around the control system to facilitate mowing operations. Location of control system should be checked with the Division Traffic Services Unit before construction.

Entry of water, mud, or dust into the control system at any time should be documented. The system shall be clean at the time of final acceptance.

All raw metal, including field cut threads and damaged galvanizing, shall be cleaned and coated with approved materials. Concrete shall be cleaned from all conduits, supports, and enclosures. The concrete foundation shall be clean and free of all dirt, mud, and stains.

Each feeder circuit should enter the enclosure through a separate conduit, or as shown on the plans. The feeder circuits should be connected to corresponding numbered breakers with Number 1 being on the left.

All conductors should have appropriate identification, including color code.

All conduits shown on the plans should be installed, including spares, which are not utilized by feeder circuits.

Coordination with the utility company is required to determine whether the service will be overhead or underground. Overhead service will require a service pole to be located near the right-of-way line for attachment by the utility company. Underground services will require a "CT cabinet" to be mounted on the back of the control system for the utility company to install a meter. CT cabinets may be furnished by the utility company without charge for installation by the Contractor.

A copy of the "as-built" plans should be placed in the control system enclosure for use by maintenance personnel.

The Technician should verify that the lights are connected to the appropriate circuit by turning the system on in manual operation and then turning off each feeder circuit breaker and observing the lights that go out.

The Technician should verify that the control system operates in the intended MAN/OFF/AUTO modes of operation. To test the AUTO mode of operation the photo control can be covered with a dark cloth. Sufficient time should be allowed for the photo control to be activated by the light and for other components to be energized.

During the performance test, the Technician should verify that the control system turns the lights on at dusk and off at dawn each day in the intended normal automatic mode of operation.

SECTION 1410
FEEDER CIRCUITS

1410-1 DESCRIPTION

This section addresses the work required for feeder circuits. See Sketch 1400-1, Page 14-3 for typical feeder circuit detail.

1410-2 MATERIALS

The Technician should verify that the conduit, fittings, conductors, and connectors are in conformance with approved submittals and that they are not damaged in any manner. All materials should be in the original shipping cartons or bundles until they are on the site for the actual installation. All like materials should be of the same manufacturer.

1410-3 CONSTRUCTION METHODS

The proposed location of feeder circuits should be clearly marked before actual installation begins. The routing of circuits should be as direct as possible between connection points. For example, if light standards are 6 feet behind the curb, the circuit should be 6 feet behind the curb.

Trenches should have neat vertical walls and should not be wider than necessary for installation of the circuits. The depth of trenches should be consistent so that circuits will lay in a smooth horizontal plane and not be deformed when backfill is placed. Multiple circuits in a trench should be laid side by side with equal spacing. They should not be twisted or overlapped. Backfill material should be properly compacted to avoid settlement.

Conduit and duct should be assembled with approved fittings. Polyvinyl chloride (PVC) conduit and duct should be joined with approved solvent cement. The ends to be joined should be clean and both pieces should be coated with the cement as recommended by the manufacturer. The pieces should be joined with a twisting motion to ensure full penetration. The cement should be allowed time to set before the joint is subjected to stress. Large size PVC conduits (4" and above) and duct usually require a primer coating on ends to be joined just prior to applying the cement.

High Density Polyethylene (HDPE) conduit should be joined by approved threaded couplings, drive-on couplings, or butt-fusing process.

Conductors should never be dragged on the ground. Payoff reels, or additional personnel, should be provided to prevent the conductors from being dragged. Conductors should be numbered at all accessible points (control panel, junction box, pole, etc.).

Splices should be mechanically and electrically secure and should be waterproof. The Contractor should be required to submit sample splices that can be analyzed and established as a standard of workmanship.

SECTION 1411
ELECTRICAL JUNCTION BOXES

1411-2 MATERIALS

The Technician should verify that each of the components (including the box and cover) match the manufacturer's catalog numbers on submittals which have been approved by the Engineer.

1411-3 CONSTRUCTION METHODS

The Contractor is responsible for marking the proposed location of electrical junction boxes for the Engineer's approval prior to actual installation of the box. Careful attention should be given to ensure that the boxes are not located in an area where they are subject to damage from traffic. This may require extending electrical duct or feeder circuits to a point behind a ditch or other protective barrier. If traffic is to operate over the box, the box shall be designed for traffic loads. The box should be placed so surface water will not enter. If this is not possible, a watertight box should be used.

SECTION 1412
UNDERPASS LIGHTING

1412-2 MATERIALS

The Technician should verify that each of the components match the manufacturer's catalog numbers on submittals which have been approved by the Engineer.

TECHNICIAN'S CHECKLIST
SECTION 1400
ROADWAY LIGHTING

Prior to Work Starting

1) Review plans and set up Pay Record book. Verify plan accuracy through field inspections. Check for encroachment on transmission right-of-way.
   a) Underground utilities.
   b) Conflicts with storm drainage and other construction conflicts.
   c) Check for level of utility investigation previously made (on utility plans).
   d) Review traffic control plan and cross-sections to eliminate conflicts with other construction activities; grading, paving, installation of guardrail, etc.
2) Make sure that utility companies have been notified of service to be provided (locate service poles).
3) Contact Division lighting personnel (in maintenance) to review plans for comments, i.e., location of service poles, location of control boxes, orientation access port for median light service.
4) Collect names and telephone numbers for :
   a) Electrical Inspector having jurisdiction.
   b) Utility company representative.
   c) Utility company which may have conflicts.
   d) N.C. ONE CALL or other locating company.
5) Preconstruction Conference.
   a) Have utility representative.
   b) Have Division Traffic Services represented.
   c) Review electrical plans and special provisions.
   d) Determine qualifications of Electrical Contractor.
   e) Set ground rules as to competent supervisions being on the construction site per Section 1400-1.
6) Pre-Lighting-Work Meeting (Article 1400-11).

Submittals and Certifications (1400-2), (1400-3)

1) Review plans for roadway lighting to have an understanding of the submittals required
2) Materials to be new unless otherwise noted. (1400-2)
3) Use only approved material (written approval by Engineer (1400-3)).
4) Submittal of eight copies of Catalog Cuts for approval. (1400-3)
5) Forty-day review time but it may take longer so send submittals early. (1400-3)
6) Submittal of all components. (1400-3)
7) Separate submittal for each contract bid item (may contain many components and some components may be in other submittals). (1400-3)
8) Certifications - See Special Provisions for changes as materials are received. (1400-3B)
   a) Complete Materials Received Report for each component received and list which pay item it is in.
   b) Take samples as required by the Engineer. Contractor may be compensated for these samples. (1400-3C)

c) Get certifications at time of delivery and note on the materials received report that the material can be used prior to getting certification since the material has an approved Catalog Cut. See Project Special Provisions for changes. (1400-3(B)).
d) Warranties- Get copies of warranties for each component, compile and turn over to Division Traffic Services at final inspection. (1400-3E)

When Work has Started

1) As-built Plans - The Contractor shall submit 2 complete sets of as-built plans. The Contractor shall keep the as-built plans updated daily. Each control panel shall have the portion of an as-built plan placed in it which pertains to that circuit (this is not part of the two complete sets of as-built plans).
2) The Engineer, unless the contract provides for contract engineering, shall locate all lights and electrical duct.
3) The Contractor shall mark all locations of other components for approval.
4) Light standards can be moved no more than 10 feet longitudinally and 2 feet laterally unless approved by the Roadway Design Unit.
5) High Mast standard foundations can be moved no more than 25 feet in radius unless approved by the Roadway Design Unit. Maintain a minimum offset of 50 feet from edge of travel unless the foundation is located behind guardrail.
6) Light standard foundations shall clear any underground conflict, which might affect the foundation stability, by 10 feet horizontal distance. Anchor bolts shall have full projection, as shown on approved submittals.
7) All underground conflicts shall have been reviewed prior to starting operations. It is the responsibility of the Contractor to have conflicts located.
8) The Contractor shall operate all equipment in a safe manner and as allowed by the traffic control plans.
9) Only electrical 90 degree sweeps are allowed with no more than three 90 degree sweeps between outlets.
10) Bury all conduit to proper depths.
11) Provide pull lines.
12) All conduit shall be clean upon completion of a system to a diameter of at least 85% of the conduit.
13) All stub-outs shall be capped with devices of the same type material.
14) Any damaged or uncoated galvanized metal shall be covered with two coats of zinc rich paint (not spray paint) meeting the requirements of the specifications. (1076-7)
15) The Contractor shall submit a splice sample for review and approval.
16) All conductors shall be color coded as noted.

Inspections by Others

1) Contractor is responsible for having each electrical system inspected.
2) Written verification shall be provided to the Engineer (certificate of inspection).
3) All work shall have been inspected and approved by the Engineer prior to any concealment.
4) All checks shall be noted in the diary and Pay Record Book.
5) The Engineer should contact the Lighting and Electrical Squad of the Roadway Design Unit to schedule a final inspection of lighting systems at least 2 weeks prior to needing the inspection.

Performance Test

1) 2 consecutive week burn-in test in automatic mode.
2) Acceptance will be made by the Engineer.
3) MEG test by Roadway Design Unit.

SECTION 1413
PORTABLE CONSTRUCTION LIGHTING

1413-1 DESCRIPTION

The Contractor shall be required to furnish artificial lighting to provide for safe, proper construction, and for inspection of the work when it is being conducted at night. See Section 105-14 of the Standard Specifications.

1413-2 MATERIALS

All equipment used should be approved by the Engineer. The equipment is to remain the Contractor's property unless otherwise noted in the Special Provisions.

The Engineer can assist in reviewing the submittal. The Contractor shall not begin night work until approval is obtained by the Engineer. An emergency plan should be discussed with the Contractor, especially if his operations are in or near traffic.

1413-3 TOWER LIGHT

Tower lights shall meet the requirements of the Specifications. Project personnel shall inspect the location of the lights at night during operation to ensure that the lights are not shining in the eyes of motorists. Document the nighttime inspections of portable construction lighting in the project diary.

1413-4 MACHINE LIGHTS

Machine lights shall meet the requirements of the Specifications. Machine lights shall be previously approved for projects with nighttime operations. The use of machine lights shall be inspected at nighttime and shall be documented in the project diary.

1413-5 CONSTRUCTION METHODS

Tower lights are normally used in a confined, fairly small, stationary type operation. More lights can allow the Contractor to open up a larger area of work.

Machine lights are typically used in moving operations. If tower lights are used, the need for machine lights may not be necessary.

All lights shall be checked at night for safe placement as well as workability. Street lighting does not eliminate the requirement for portable construction lighting. Consideration of street lights should be made in determining the lights required. A log should be kept when checking traffic control items/lighting. Never allow an unsafe operation.

TECHNICIAN'S CHECKLIST
SECTION 1413
PORTABLE CONSTRUCTION LIGHTING

1) The Contractor is required to submit catalog cuts for approval. Forty days should be allowed for processing.
2) Check equipment against the approved Catalog Cuts.
3) Lighting placement and orientation should be checked and documented.
4) Night inspections should be documented.
5) Never allow unsafe operations at night!